Comparison of quantification and image quality for different iodine isotopes (I-123, I-124 AND I-131)

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I-131 is often used for radionuclide therapy. This technique for cancer treatment requires a pretherapeutic dosimetry study. The latter is usually performed (for this radionuclide) by directly imaging its uptake in the body or by replacing it by one of its isotopes, more suitable for imaging. This study proposes to compare the quantification and the image quality that can be achieved by three iodine isotopes: I-131 and I-123 for Single Photon Emission Computed Tomography (SPECT) imaging, and I-124 for Positron Emission Tomography (PET) imaging.
The imaging characteristics of each isotope were investigated by simulated data. Their spectrums, point spread functions and contrast recovery curves have been drawn and compared. I-131 has been imaged with a HEAP (High Energy All Purpose) collimator while two collimators were compared for I-123: LEHR (Low Energy High Resolution) and MEGP (Medium Energy General Purpose). No mechanical collimation was used for I-124.
Results show that even small high energy peaks (>0,1%) produce significant contamination in the main energy window. Furthermore, system matrix based reconstruction improves the quantification and the image quality. I-124 gives the best imaging properties due to its electronic collimation (high sensitivity) and a short coincidence time window. I-123 gives best results with a LEHR collimator when the scatter correction is applied. Without correction, the MEGP collimator reduces the effects of high energy contamination. I-131 offers the worst results. This can be explained by the large amount of septal penetration from the photopeak.

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